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**AN ACCOUNTING SYSTEM FOR INCINERATOR
OPERATIONS**

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**Bureau of Solid Waste Management
Rockville, Maryland**

1970

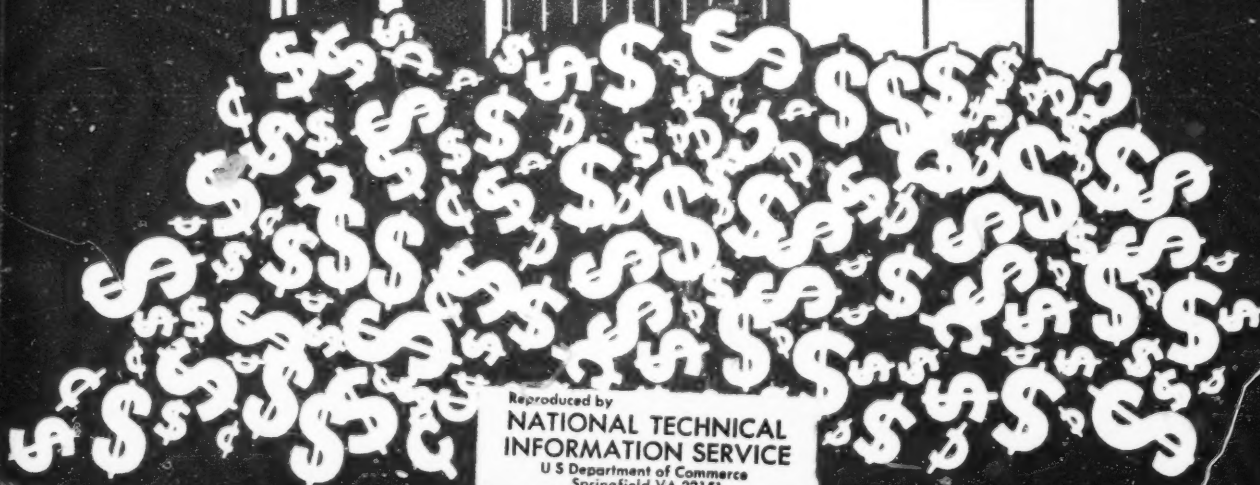
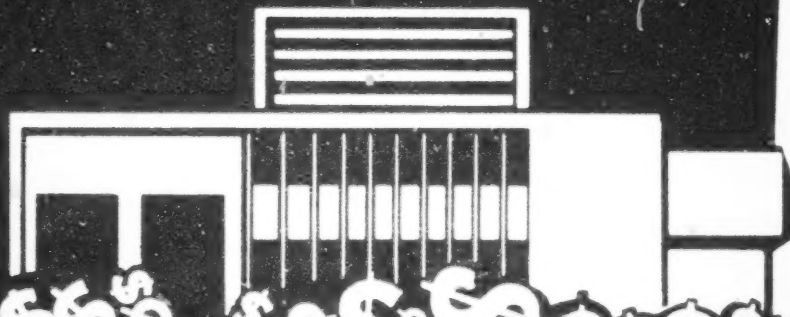
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This report (SW-171a) was written by

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AN ACCOUNTING SYSTEM

**for
incinerator operations**

Eric R. Zausner*

Effective solid waste management requires an adequate information system including data on activity and the costs of operation and ownership. Although a cost accounting system represents only one part of the total system, it does facilitate the collection and later utilization of the data obtained.

Present information on incineration and its associated costs is both inadequate and nonstandardized. The proposed system provides a guide to the type and quantity of information to be collected, its classification, and the method of collection. Incinerator supervisors and heads of agencies responsible for their operations will find the system useful.

A cost accounting system can aid a community in controlling the costs and performance of its incinerator operations, as well as aid in formulating future plans.

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System Benefits

Some of the more important advantages are:

1. The system facilitates orderly and efficient collection and transmission of all relevant data. In fact, most of the data recorded is probably being collected already, although perhaps only sporadically and inefficiently. Hence, the added cost of installing the proposed system is minimal.
2. Reports are clear and concise and present only that amount of data required for effective control and analysis. They can easily be completed and understood by incinerator personnel.
3. Interpretation of results and comparison with data from previous years or from other communities is simplified. This allows analysis of relative performance and indicates areas where corrective action is needed.
4. The system accounts for all relevant costs of operation.
5. Because the system indicates high costs and their underlying causes, the supervisor can control costs more effectively. Similarly, performance and efficiency may be monitored and controlled.
6. Accountability is superimposed on the system to indicate who is responsible for the increased costs.
7. The data provided are in a form that aids in short- and long-range forecasting of operating and capital budgets. Future requirements of equipment, manpower, cash, etc., can be estimated to aid budgeting and planning at all levels of municipal government.
8. The system, with only minor modifications, is flexible enough to meet the varying requirements of incinerators of different sizes.

Cost Centers and Cost Allocations

The complexity of incinerator operations requires a breakdown and description of operations to facilitate analysis. In this report, the incinerator is assumed to consist of several interrelated suboperations, each of which is analyzed separately. These suboperations are called cost centers because costs are accumulated separately for each of the major functional activities. Analysis and control are simplified if excessive costs or inefficiencies can be traced to a functional activity or area of the facility.

The number of cost centers increases as the size and complexity of operations increase. More cost centers, however, require the collection of more data and, therefore, increase costs. For most facilities, four cost centers appear to collect adequate data without incurring excessive collection costs.

Three of the four cost centers (Receiving and Storage, Volume Reduction, and Effluent Handling and Treatment) are termed the direct cost centers because they can be directly associated with certain incinerator operations and unit processes. The operations included in each follow the process flow from input of raw wastes to output of effluents (Diagram I). The fourth, the Repairs and Maintenance cost center, cannot be directly associated with waste processing. Therefore, it is separated from other operations and not shown in the diagram. Because it incurs a large percentage of operating costs, a separate analysis is needed.

Although fewer cost centers would never be required, larger operations may require more cost centers. For instance, the Effluent Handling and Treatment cost center could be divided into Air Pollution, Water Treatment, and Residue Handling cost centers. Similarly, salvage or heat utilization operations should be put in separate cost centers.

These cost centers classify the operations by function. The costs incurred are for labor, parts and supplies, utilities, and overhead, and they must be allocated to the cost centers in an accurate and representative manner (Diagram II). Note that costs are first allocated to all four cost centers; the Repairs and Maintenance cost center is then allocated to the three direct cost centers. The result is the total operating cost for each direct cost center.

There are many alternatives for actually allocating the operating costs. A straight-forward method for each type of expense will be outlined. Labor costs may be allocated to the four cost centers based on the relative number of hours employees worked in each area and their respective wage rates. Utilities may be allocated based on an engineering estimate of the relative usage rates of the equipment in each cost center. Both water and electricity should be allocated. Parts and supplies will be allocated to each direct cost center

DIAGRAM I
INCINERATOR COST CENTERS

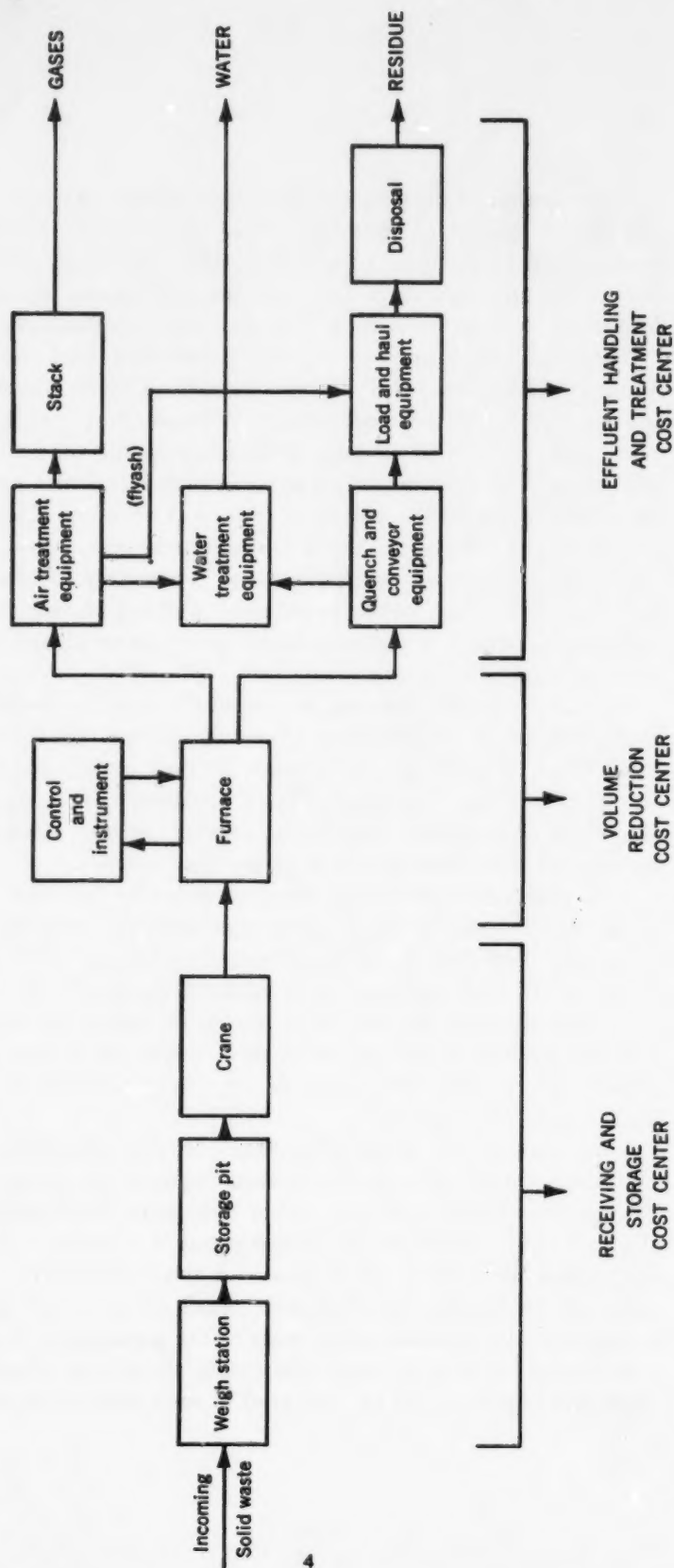
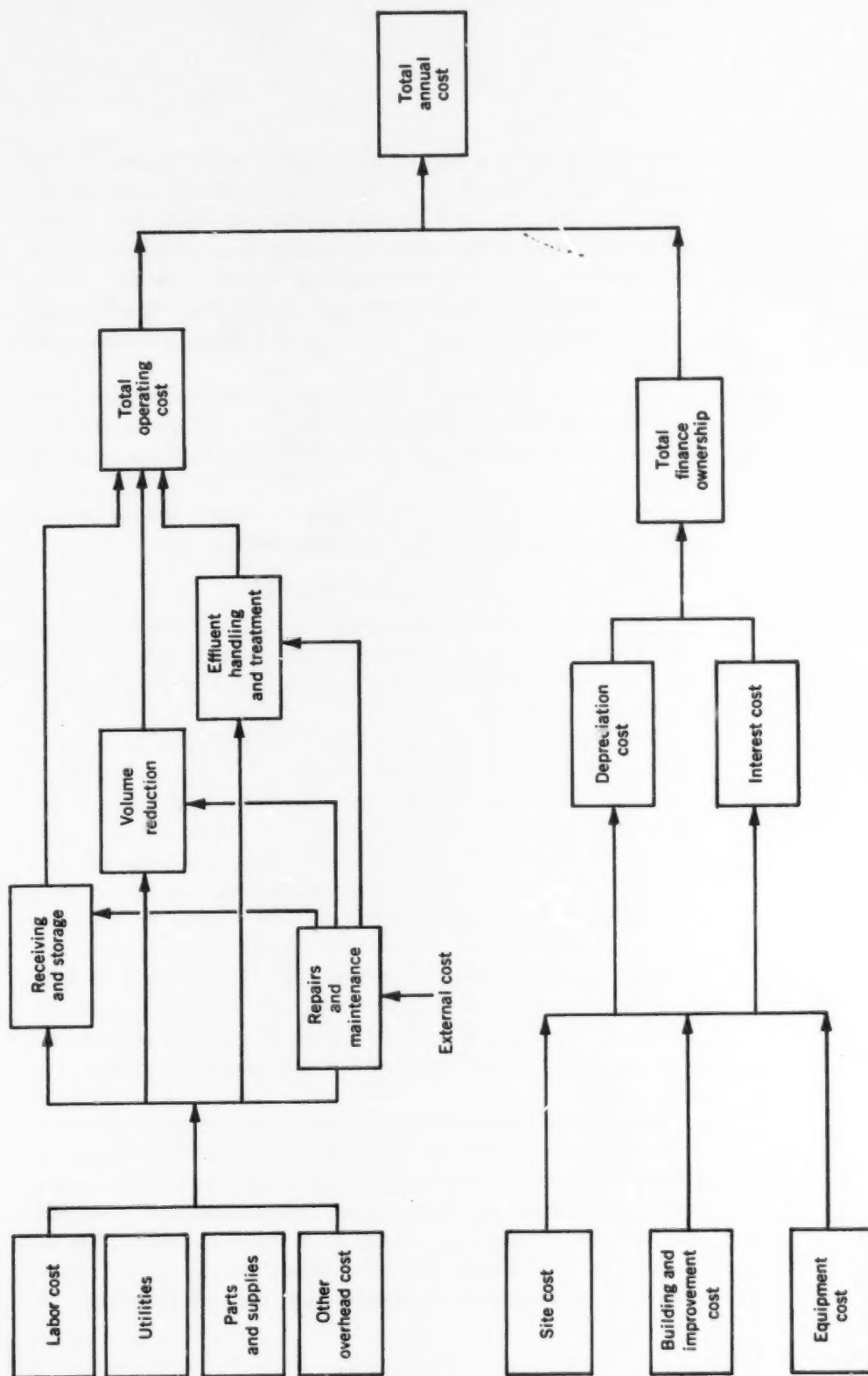


DIAGRAM II
ALLOCATION OF COSTS



after first being recorded in the Repairs and Maintenance cost center. General overhead, which includes supervision, insurance, etc., can be allocated equally to each cost center or on the basis of the relative number of employees in each cost center. The latter technique is recommended. Finally, the Repairs and Maintenance cost center is allocated to the three direct cost centers based on the actual expenses incurred in each one.

The sum of the costs of these three direct cost centers is the total operating cost. The total annual cost of operations represents these operating costs plus the costs of financing and ownership.

The actual forms are designed to facilitate the collection and later allocation of costs to these cost centers.

Forms and Reports

The reports are most easily grouped into those that are used to collect the data on operations and those used to reduce and present the data for the purposes of analysis, decision making, and control.

This data reduction and presentation cannot be accomplished without the daily recording of all pertinent activity and cost information. Data not recorded daily are not retrievable at some later date. Incinerator personnel, supervisors, and others involved in operations primarily use the following forms (1 through 4) to record the data required.

Weekly Labor Report (Form 1). Daily entries of labor activity are recorded in duplicate at the site. One copy is forwarded to the payroll department for determining weekly wages. The incinerator supervisor and the accounting department use the other copy for computing total labor hours and assigning these hours and associated costs to the four cost centers.

Daily Truck Record (Form 2). The waste received and residue removed, as well as the types and sources of waste received, are recorded manually on this form for the entire day. (If the incinerator has a scale that automatically records the weight information, that part of the form would be replaced by the weight ticket or record of the scale.) Each delivery is recorded separately by the weighmaster. A

SHIFT: _____

Instructions: Incinerator supervisor to complete this form daily. List all employees separately including temporary help. "Hours" refers to hours worked daily. At the end of each week forward one copy to the payroll department and retain the original for further use.

Abbreviations of cost centers and workers to be assigned to each: R&S = receiving and storage; crane operator, weightmaster, tipping floor, and charging attendants. VR = volume reduction: stokers, control monitors, etc. EHT = effluent handling: residue haulers, disposal site operators, etc. R&M = repairs and maintenance: include all general maintenance workers and part time repairmen.

DAILY TRUCK RECORD

FORM 2

INCINERATOR: _____

DATE: _____

SIGNATURE: _____

SHIFT: _____

No.	Truck * identification	Time	Wastes		Weight in	Weight out (or tare weight)	Net amount	
			Source	Type ‡			Wastes	Residue
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
12								
15								
16								
17								
18								
19								
20								
Totals		X	X	X	X	X		

Instruction: To be completed by weighmaster for each delivery of waste or removal of residue.

* Truck identification is number of the public truck; if private vehicle, the name of company for billing purposes.

† Source: R = residential; C = commercial; I = industrial.

‡ Type: R = rubbish; G = garbage (also unusual items).

second weighing of the empty truck may be taken or the vehicle's tare weight (as officially determined by a licensing agency, etc.) may be substituted. The form is forwarded to the accounting department at the end of each month. In addition to utilizing recorded weight data to bill private users later, the sources and types of waste data are useful in special analyses of trends, compositions, and distributions of solid wastes in the community.

Daily Report on Incinerator Operations (Form 3). When there is actual downtime and repairs are required, the expenses that will be allocated to the three direct cost centers are recorded on the lower half of the two-purpose report. These data are particularly useful in analyzing equipment performance and cost. In addition, data on utility usage are recorded on the form at the end of each month.

The top of the report is used to summarize the daily operations. The employee and activity data give management personnel who are not at the site daily, but who still require daily feedback on operations, a quick and accurate summary of the day's activities. The performance data are also useful in assessing daily efficiency. The report is completed daily, sent to the main office, and filed for later use.

Incinerator Capital Investment Report (Form 4). This form is completed when construction is finished or when the cost system is first implemented. Only when improvements or new equipment are either constructed or purchased is it updated. In addition to collecting the data required to calculate depreciation for the period and allocating it to cost centers, the form also summarizes the bond and interest information required to compute the total costs of financing and ownership.

For the most part, Forms 1 through 4 are utilized to collect the data associated with the construction and operation of an incinerator. The cost of accumulating these data can only be justified by its intensive and effective utilization. This is accomplished by meaningful data reduction and presentation. The data must be presented clearly and quickly to the personnel who can use it most effectively for analyses and

DAILY REPORT ON INCINERATOR OPERATIONS

SITE: _____

DATE: _____

PERFORMANCE DATA
% Weight reduction ($\frac{\text{residue}}{\text{wastes burned}}$):
Man hours per ton:
Tons of residue per trip:
Number of injuries:

EMPLOYEE HOURS				
Cost center	Shift			
	1	2	3	4
Receiving				
Volume reduction				
Effluent				
Repairs				
Totals				

ACTIVITY DATA		
	Loads	Tons
Wastes received		
Wastes burned		
Left in pit		
Residue		

REPAIRS AND MAINTENANCE DATA								
Equipment description	Cost center	Cause	Hours down	Labor hours	Labor cost	Parts cost	External costs	Total cost

UTILITY DATA
(Only complete this section at the end of the month)

	Electric	Gas	Water
Meter reading	_____	_____	_____

INCINERATOR CAPITAL INVESTMENT REPORT

INCINERATOR: _____

DATE: _____

Description	Size, capacity, amount, etc.	Date put in use	Estimated total life	New cost	Other comments	Yearly depreciation	Monthly depreciation
Site:							
Land						X	X
Surveys							
Preparation							
Roads							
Other							
Buildings:							
Scale house							
Pit							
Offices							
Main building							
Stacks							
Other							
Equipment:							
Scales							
Crane(s)							
Furnace(s)							
Air pollution							
Water treatment							
Residue removal (including vehicles)							
Instrumentation and control							
Other							
Totals	X	X	X		X		

FINANCING DATA

Bond type	Face value	Premium or discount	Interest rate	Yearly interest *	Monthly interest

Instructions: To be completed by supervisor or accounting department. Depreciation may be straight-line or on an accelerated basis.

* Interest must account for net effect of premium or discount on bond sale.

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control. The following forms (as well as Form 3) are designed to fulfill these objectives.

Incinerator Operations Summary (Form 5). This form summarizes six distinct groups of information about incinerator operations for a specific period. For control purposes, monthly reports would be desirable, although less frequent preparation would be possible. The first two segments present activity and operating cost data for the total operation. Costs are broken down by type to aid the cost analysis, and the activity and performance factors are designed to help analyze inefficiencies and performance. The remaining four sections break the costs into the four cost centers. Total operating costs are presented for each area as are other factors that may be useful to analyze the functional activities. Obviously, there are many other factors and costs that could be presented. The ones illustrated, however, are adequate for most analyses. Nonetheless, modifications or additions should be made for facilities with different operations and data requirements.

This form, designed for control purposes, contains only controllable expenses for which the supervisor can be held accountable; capital or financing costs are not included. The form is prepared by the accounting department from the data in Forms 1, 2, and 3 and additional data on file concerning labor rates, insurance, fringe benefits and charges from other departments, external expense billings, etc. Copies of the form are forwarded to both the facility supervisor and to his superior. Analysis of the form indicates excessive expenses and aids the supervisor in taking corrective action.

Incinerator Total Cost Report (Form 6). All the activities and costs incurred by the incinerator during the period are summarized from data in present and past Incinerator Operations Summaries (Form 5) and from the depreciation and interest data available in the Incinerator Capital Investment Report (Form 4). Semiannual and annual preparation would be sufficient. Form 6 — Alternate can be used if disposal charges or other types of revenues are associated with incinerator operations.

INCINERATOR OPERATIONS SUMMARY

INCINERATOR:

REPORT PERIOD: from to

ACTIVITY AND PERFORMANCE		
	Actual amount	± % Budget variance
Tons incinerated		
% Weight reduction		
Total labor hours		
% Capacity utilized		
% Capacity available		
% Utilized/% available		

OPERATING COST TOTALS		
	Actual amount	± % Budget variance
Total operating cost		
Total labor cost		
Utilities cost		
Parts and supplies		
Outside charges		
Overhead		

RECEIVING COSTS		
	Actual amount	± % Budget variance
Total operating cost per ton		
Labor hours		

VOLUME REDUCTION COSTS		
	Actual amount	± % Budget variance
Total operating cost per ton		
Labor hours		
Average operating temperature		

EFFLUENT HANDLING COSTS		
	Actual amount	± % Budget variance
Total operating cost per ton		
Gallons of water per ton		
Tons of residue per load		

REPAIRS AND MAINTENANCE COSTS		
	Actual amounts	± % Budget variance
Total operating cost		
Receiving repair costs		
Volume reduction repair costs		
Effluent handling repair costs		

INCINERATOR TOTAL COST REPORT

SITE: _____ REPORT PERIOD: from _____ to _____

Data	For this period	±% Variance from budget for this period	Year to date	±% Variance from budget for year to date
Tons incinerated				
Weight reduction				
14				
Total operating cost				
Total financing and ownership cost				
Total cost				
Operating cost per ton				
Financing and ownership, cost per ton				
Total cost per ton				

Instructions: To be completed by accounting department from data available in "Incinerator Operations Summary" and "Incinerator Capital Investment Report" when requested or periodically. Copy sent to city manager, head of department of public works, or their equivalent.

FORM 6 - Alternate

INCINERATOR TOTAL COST SUMMARY

SITE: _____ REPORT PERIOD: from _____ to _____

Data	For this period	Budget—this period	Year to date	Budget—year to date
Tons of waste incinerated				
Percent weight reduction				
Total operating cost				
Total financing and ownership cost				
Total cost				
Operating cost per ton				
Financing and ownership cost per ton				
Total cost per ton				
Revenues—other communities				
Revenues—private collectors				
Revenues—miscellaneous				
Total revenues				
Total revenues per ton				
Net cost (profit)				
Net cost (profit) per ton				

Summary of Information Flow

Operating data are accumulated daily at the incinerator site and transmitted periodically to the accounting department. The accounting department combines these reports with additional information it accumulates to get total operating costs. This summary is then returned to the supervisor for his own use. Next, the accounting department combines the operating cost data with the depreciation and interest cost data (from the Incinerator Capital Investment Reports) to compute total costs for the period. This total cost information is then given to the heads of departments of sanitation and public works, or their equivalents.

System Utilization

Only with efficient and intensive utilization of the information generated from the accounting system and forms can the additional time, effort, and money required to implement and maintain the system be justified. The system's intensive use promotes two major objectives: quality control and cost control. Reduced costs must be accomplished without deteriorating and operating quality. Similarly, quality is interrelated with the costs of obtaining it.

All the factors that affect the quality and effectiveness of incinerator operations can be translated into costs. Amount of volume reduction, residue characteristics, and the levels of stack emissions and water pollution determine the quality of operations. Cost control does not call for economizing at the expense of quality. On the contrary, once a level of acceptable operation has been determined along with the attendant costs, the cost control system can help the supervisor maintain that level of operation.

Effective cost control requires timely recognition of excessive costs and identification of responsibility for the increased costs. Comparing unit costs (cost per ton of waste incinerated) with both the current budget and the corresponding period last year helps indicate excessive costs. The use of unit cost facilitates the analysis of costs, independent of changes in the level of activity. The cost-center breakdowns help single out the responsible factor or person. This system

allows both of these critical factors to be determined, corrective action may then be effectively initiated.

The Incinerator Total Cost Report (Form 6) can indicate to the highest level of municipal management, i.e., the city manager or the head of the sanitation department, if costs are excessive. If so, the supervisor of the particular facility can be held responsible to the extent that his operating costs have increased. The supervisor, in turn, can analyze the cause of this cost rise. He may trace the increased cost to the type of cost, as well as the cost center, and possibly to the employee or piece of equipment responsible. All of the needed data are in Form 5 (the Incinerator Operations Summary).